Breakout Session 9: Frontiers in Optics

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DSO Proposers Day

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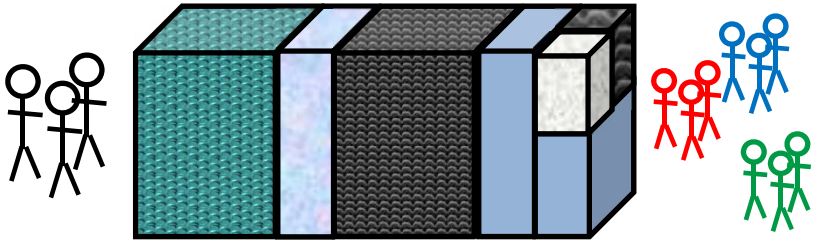
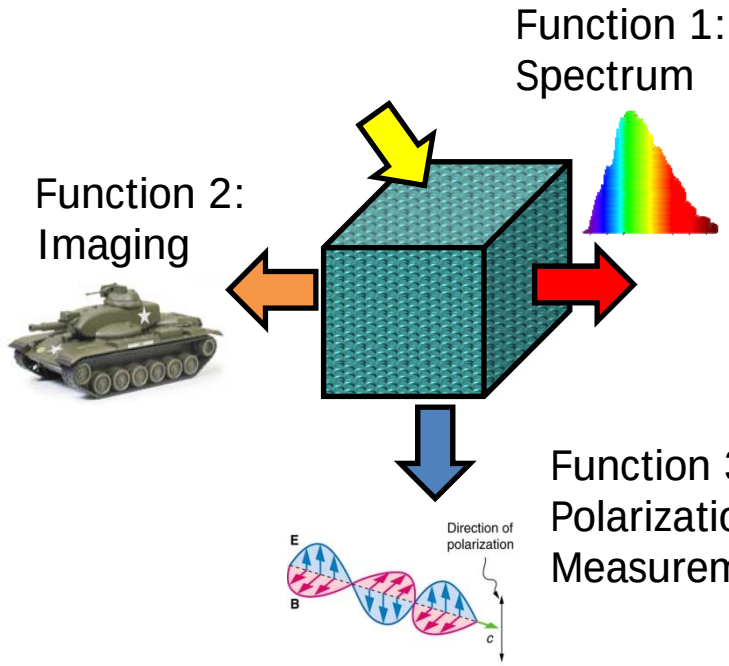
Multifunctional Volumetric Optical Metamaterials

Example: Optic that images and spatially separates spectra for high efficiency color imaging



Volumetric Optic Operating in Series

Combination of scattering structures, periodic, (a)periodic metamaterials, and possibly bulk optics to perform some complex mapping that would normally require multiple elements and significant free space propagation.

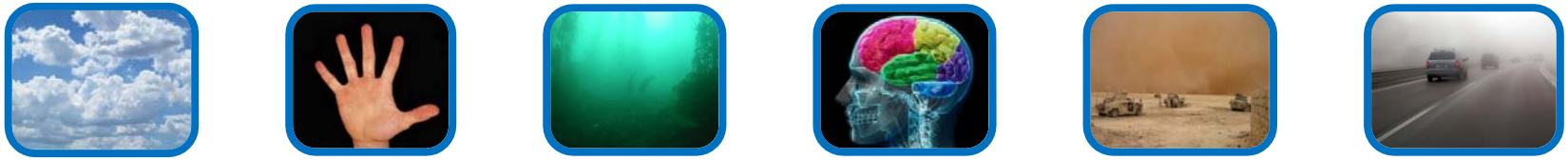


Volumetric Optic Operating in Parallel

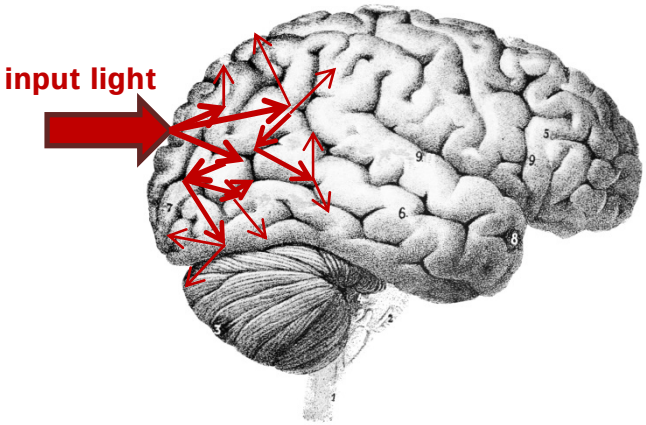
Volumetric “sugar cube” of metamaterial where each face serves as an output port for some useful function or mapping.

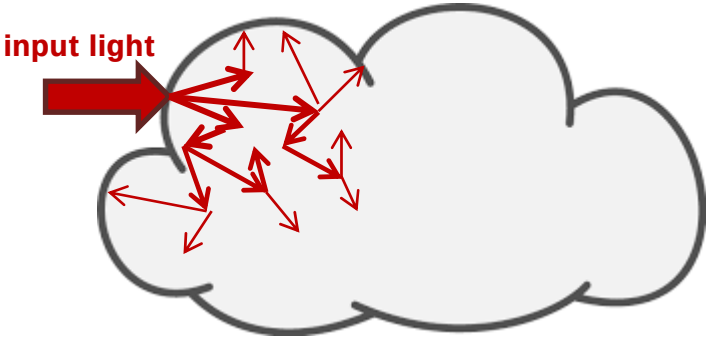
- How many optical functions can be interleaved within a fixed volume? How does the quality of measurements scale with the number of functions?
- Are there methods for designing new resonant structures for a specified function? What are the optimal meta-atoms?
- Discuss Layered metasurfaces vs. 3D volumes; capabilities, limitations, bounds of performance, etc.
- What are the possible configurations for a volumetric multifunctional optic? Series? Parallel? Something else?
- Where will the fabrication (and design) technology allow us to make the most progress and what are the current gaps?

Imaging Through Highly Scattering Complex Media



Clouds, tissue, sandstorms, water, snow → all are highly scattering, not opaque.





In highly scattering media, light changes trajectory many times before absorption.

Conventional wisdom: After 5-10 bounces, imaging is effectively impossible.

What are the fundamental limits to imaging depth?
Would it ever be possible to image through 100 scattering depths?